Habitat Preferences of *Littorina sitkana* on Two Shores of Differing Exposure in Alaska

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During the summer of 1963 an extensive investigation of the intertidal ecology of the shores of Three Saints Bay, Kodiak Island, Alaska, was undertaken by the author, an area which was subsequently submerged about 3.0 feet in the Alaskan Earthquake of March 27, 1964. In the course of this investigation, the greater part of which will be reported elsewhere, several aspects of the ecology of the common shore mollusks were revealed and one is reported here.

Three Saints Bay lies on the southeast coast of Kodiak Island about 60 miles from the city of Kodiak. The bay is in the shape of an "Γ", and is ringed with steep sided mountains which rise, in most areas, abruptly from the bay. Almost all intertidal areas are solid rock, boulders or cobble. There are no true muddy shores.

The two shores under consideration here lie on opposite sides of the bay, one on the west shore and the other on the east shore. The beach on the west side of the bay, designated as the Beach Transect Area, was well protected from any wave action in the bay proper by a peninsula of land which curved around in front of the sampling area cutting it off from the mouth of the bay and leaving a wide opening to the bay proper only in the direction of the head of the bay. As a result of the existence of the peninsula, a quiet water lagoon was formed fronting the sampling area.

The sampling area on the east side of the bay, designated as the East Reef, was on the exposed side of a peninsula which extended out into the bay and faced the mouth of the bay and the incoming sea swell, although wave action was never severe due to its location a mile up the bay from the mouth.

The substrate of the Beach Transect Area was coarse gravel or cobble except at the lowest levels of the tidal zone where a flat area of sandy-mud occurred.

The substrate of the East Reef was similar except that the area also had numerous large (12 - 16 inches) rocks dotting the surface or imbedded in the surface pavement of cobble.

Both of these sample areas were very sharply zoned into three bands, and these zones and their major components were the same on both areas. The lowest zone of each reef was green in color and entirely dominated by eelgrass (*Zostera marina* Linnaeus, 1758). The middle zone was a dark brown color due to the presence of large amounts of the alga *Fucus distichus*. The highest zone was black in color, due to the exposed bare cobble and rocks, interrupted by patches of white which indicated the presence of numerous barnacles (mainly *Balanus cariosus* (Pallas, 1788)). This zone was completely devoid of macroscopic algae. These zones were named Eelgrass, Fucus, and Barnacle respectively.

The two areas were sampled by different methods, and hence are not directly comparable. However, the results are so dramatic that it is felt that the differences are not an artifact of the sampling methods, but represent a true picture of conditions. The Beach Transect Area was sampled by 5 belt transects of contiguous 0.25 m^2 quadrats running from low water to the level reached by the highest tides. In all, 286 quadrats were taken and 22570 *Littorina sitkana* Philippi, 1846, individuals were counted.

The East Reef was sampled by 55 0.25 m^2 quadrats which were chosen at random from a grid set out over the entire area. A total of 2661 *Littorina sitkana* were counted.

Littorina sitkana was a prominent member of the fauna of both the sampling areas. However, analysis of the quadrats by individual zones in which they had been taken revealed a dramatic unexpected change in habitat for *L. sitkana* in the two areas (Table 1).

Although *Littorina sitkana* had been found almost exclusively in the *Fucus* zone of the Beach Transect Area, not a single individual was found in this same zone in the East Reef (Table 1). It seems certain that had more quadrats been taken in the East Reef, at least some individuals of *L. sitkana* would have been found in the *Fucus* and Eelgrass zones, but the preponderance of individuals would still have been in the barnacle zone.

Table 1

Percentage of Total Number of Individuals of *Littorina sitkana* in Each Zone

Zone	Beach Transects[1]	East Reef[2]
Barnacle	4.7	100.0
Fucus	94.6	0.0
Eelgrass	0.7	0.0

[1] Total of 22570 individuals counted in 286 $\frac{1}{4}m^2$ quadrats.

[2] Total of 2661 individuals counted in 55 $\frac{1}{4}m^2$ quadrats.

Since the zones and organisms characterizing the zones were similar in both areas, this marked change of zone of occurrence of *Littorina sitkana* is most interesting and invites speculation as to its cause. One obvious explanation is that it is due to the differing exposure factors of each area, especially wave action. The possibility that this change is due to the presence of the large rocks on the one reef and not the other cannot be discounted here, but appears to be of lesser importance due to the observation that *L. sitkana* was not always associated with the large rocks on the East Reef, but was often found on the small cobble.

Another explanation of the change may be found in the differences in tide level of the zones on the two areas. On the Beach Transect Area the *Fucus* zone was found between + 0.5 feet and 4.5 feet (MTL) whereas on the East Reef the *Fucus* zone was a much narrower band occurring only between 0.0 feet (MLLW) and + 1.8 feet. Hence, at least part of the Barnacle zone of the East Reef occurs at the same tidal levels as the upper part of the *Fucus* zone in the Beach Transect Area. Although this certainly offers a partial explanation of the disparity observed, it probably is not the only answer since closer analysis of the Beach Transect data for *Littorina sitkana* showed that the greatest densities occurred in the tidal range of + 1.0 to + 2.0 on the Beach Transect Area, precisely the level of the *Fucus* zone on the East Reef.

Perhaps all of the above factors enter into this situation, and it is not known which, if any, is of most importance.

Since *Littorina sitkana* is a common intertidal mollusk of the northern parts of the Pacific Coast of America (Ricketts & Calvin, 1939) and the genus has been considered as characteristic of certain levels of the shore (Stephenson & Stephenson, 1949), it is of interest here to report this marked change of habitat between two shores which are, in most respects, quite similar. Results obtained in this study would seem to indicate that *L. sitkana* cannot be used as an indicator species for a single zone, at least in Alaska, and that relatively small differences may alter markedly its distribution on a shore.

LITERATURE CITED

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